The Gardens' Bulletin

STRAITS SETTLEMENTS

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THE

GARDENS' BULLETIN,

STRAITS SETTLEMENTS.

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FORESTS AND THEIR RETENTION OF RAIN WATER.

Fifty years ago a forester named Surell, published a study of torrents in the High Alps (Etudes sur les torrents des Hautes-Alpes 1870), a book that ran to a second edition two years later under the editorship of another,—E. Cézanne. In this work the re-afforestation of bared slopes was advocated as a remedy against landslips and denudation resulting from streams in flood. The book led the way for reports, such as Demontzey's "Removal of torrents in France by re-afforestation" (L'extinction des torrents en France par le reboisement, 1894). Yet, though by the end of the last century the principle had been recognised that forests prevent this kind of destruction, many, some resenting forest regulations, failed to realise their true importance: and therefore in 1900 a demonstration of the influence of forests upon the running off of the rainfall was commenced in Switzerland by that country's Central institute for the study of Forestry. For the demonstration two comparable valleys near Berne were selected; one with forest throughout, the other two-thirds in pasture. Rain guages were installed; and guages put upon the streams that carry the water away. As no arrangements could be made for keeping records at temperatures below freezing point, winter-observations were impossible: but after 18 years of observation in each year from April 16th to November 30th, the results have been published by Dr. Arnold Engler under the title of *Untersuchungen ueber den Einfluss des Waldes auf den Stand der Gewasser.*

The fate of the rain which fell, it is concluded, was:—

	from the forest	from the open
to be run off through the streams ..	60 parts	60 parts
to be evaporated from off the surface of the vegetation	5 ,,	10 ,,
to be evaporated from off the surface of the soil	15 ,,	24 ,,
to be taken up by the roots of the vegetation and thence passed back to the air by transpiration	20 ,,	6 ,,
	100 parts	100 parts

Now the last process takes time and it is obvious that the water so used must be delayed in its circuit: but the chief interest is the rate at which the 60 per cent was run off in the streams. It was run off rapidly from the pasture but slowly from the forest: thus in the springs when the thaw came, the forest allowed the liberated water to escape much more slowly than the pasture: and through the summers when sudden downpours occurred, the stream from the pasture valley for a time would discharge per second twice to thrice as much water as the stream from the forested valley, for the same fall of rain. In times of protracted rain the discharge per second would be something up to twice as much, the difference growing less, the longer the downpour extended; this is as one would expect for every soil has a limit of saturation, beyond which it can retain no more.

It follows from the way in which the first valley parted slowly with the rain that its forest soil must be much more uniformly moist than the pasture soil: but the reason for this is not, as most think, because the forest covering prevents the sun from reaching the soil; but is in the circumstance that a forest soil is absolutely different from one more exposed: it possesses properties for instance which it keeps for a time after the forest is removed, which we refer to when we call it a "virgin soil;" and the most useful of all the properties of virgin soil from a forest is that of holding moisture against the dessicating effects of exposure to the sun.

Several factors assist in bringing this about.

There is more humus in a forest soil than in a pasture soil; and the decay of the humus opens it: there are more roots in a forest soil than in a pasture soil; and they open it: and almost certainly there is an entirely different soil fauna, which brings about enormous differences. Possibly other differences could be enumerated; but the result of all is that forest soil has a porosity lacking in exposed soils, cultivate them as we will.

That the differences observed in the running off of the rainfall from his afforested valley and from his deforested pasture valley are due to the nature of the soil Dr. Engler appears to have no doubt.

The water of the stream from the pasture valley carried more sediment than that from the afforested valley.

Had the Swiss Institute's experiments been a comparison of an afforested valley with a bared valley, how much greater would the contrasts have been; and how much more forcefully would the second stream have poured down in flood, carrying the soil with it.

These Swiss observations have considerable interest in Malaya.

The porosity of a forest soil is well illustrated in the Peninsula by the way in which the peat-lands of Kukob and other low-lying places shrink if exposed for the cultivation of rubber. The steady release of the rainfall by hill forest is pleasantly shown in the early rice crops that the narrow upper ends of the valleys give in Malacca. The consequence of the removal of forest has been obvious enough in the same neighbourhood where the Railway has had to alter its

culverts that were silted up. Perhaps there are no records which would show that the Malacca river is less constant than formerly, but it is more than probable that it is less constant as a consequence of the extensive clearing of the rolling ground about the Malacca-Negri Sembilan boundary.

Virgin forest soils are, in Malaya, most interesting. They can be destroyed in a few years; but it would seem that they can only be build up by several tens of years; perhaps it takes one hundred to restore them. At any rate the real forest trees appear to demand one hundred years§ of preparation before they are again at home. Belukar in all its stages is the evidence of soil unfit for them. What they need and the soil has not got when carrying belukar is probably porosity plus the right soil fauna; and of soil fauna here we are extremely ignorant.

I. H. Burkill.

SOME TESTS OF GARDEN VEGETABLES IN SINGAPORE—LETTUCES.

If reference be made to this Bulletin Vol. 2, No. 1, 1918, p. 9, a note will be found by Prof. C. F. Baker upon lettuces tried by him in the Economic Garden, Singapore. Since then, other lettuces have been tried, and the last of the experiments done, will be reported on here.

The seed came from three different firms, Messrs. Sutton and Sons, Reading, England; Messrs. Vilmorin, Paris; and Messrs. Dreer & Co. Philadelphia U. S. A. The lettuces of different origin could not be tried against each other, as it was impossible to sow them together, but those from each firm were grown side by side.

The method of cultivation was as follows:—

Soil and site. The soil selected for growing these was of two sorts (1) sandy loam; and (2) rich damp loam obtained from peat by constant cultivation, good drainage, and incorporation of lime. The soil was dug over twice, manured with cow manure at the same time, and then left exposed to the sun. After a week or so, beds 3 ft. broad and long according to the site, were made, and kept ready to receive the seedlings.

As for the sites, they were two: the first was above the zone of floods which have become somewhat frequent in the Economic Garden in the early part of the year; while the second was liable to flood. The first situation answered well while the weather was wet and in the dry spells with precautions, in giving water, keeping a fine dust mulch and giving shade in the middle of the day.

Germination and growth. Soon after the seeds were received they were sown in boxes in a soil with an addition of sand to run off extra water and to prevent damping off. The seeds usually

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§ Cf. in the Gardens' Bulletin II No. 5, pp. 145—157, an account of Secondary jungle thirty years old.

took 40-48 hrs. to come up; but if not sown promptly—in some cases, it was not possible to do so—they took longer even up to 5-7 days to germinate. The cause may be sought in weakened vitality which is lost exceedingly early in this hot moist climate.

When the seedlings were 2-2½ ins. high, that was in 7-9 days, they were transplanted into the beds in the afternoon or in cloudy days all the day long, in rows with 9″ between the rows and also 9″ between the seedlings.

A fortnight from transplanting, when the seedlings had taken, an emulsion of cowdung, (1 bucket of dung to 8 of water) was poured in between the rows. Fish manure and burnt earth were also used, but the first was found to be the most suitable, for it is in a more assimilable form. The growth was rapid after this and the salads were uprooted as follows.

Suttons'	after 41 days.
Dreer's	43 „
Vilmorin's	44 „

The weighments showed that the maximum weight was reached 10-15 days later; it gradually rose from ¾ oz. or 1½ oz. according to the type to 2-3 ozs. when the maximum growth was recorded.

Weather did not treat the different sowings equally, for there were constant changes in it from dry to wet, wet weather being unusually prevalent during the first quarter of the year of 1921. The lettuces in the damper situations grew very well in the dry spells; but in wet periods, those on the sandy loam did better. Artificial shade is essential in the seedling stage for 2-3 weeks in varying degree according to the weather to keep off heavy rains as well as midday intense heat; shade also prevents too much evaporation of water from the sandy loam; while in the case of damp soil, it keeps the air in contact with the plants humid.

Almost all strains succumbed to hard rains but least those which have long leaves—cos type—or behaving as cos. In wet periods, most of the lettuces lost much of their foliage.

Another noticeable feature of lettuces, is that, though warranted as Cabbage type, in this forcing climate. they did not behave as such. Many ran to stem; while a few only form loose and all less compact heads. Cos or behaving as cos, were early ones while the other type was later by a week or so.

The lettuces were distributed for opinion to many people, and the following were appreciated.

Suttons'. Ideal, Nonsuch, Early Paris, Golden Ball, and of these there was an unanimous opinion that Ideal and Nonsuch were the best.

Dreer's. Early curled Simpson, Black seeded Simpson, Mammoth salamander, Big Boston, Improved Hanson, Golden Queen, Wonderful.

Vilmorin's. Green Provence. Unfortunately Vilmorin's lettuces were sunk under flood water on 5/5/21 and therefore were not given full trial.

Sorghum Vulgare Millet, Sown on 21st August, gathered 4th December.

The lettuces by growth could be classed as (1) *heavy-type-salads*:—Ideal, Matchless, Iceberg, Mammoth Salamander, Black-seeded Simpson, Way-ahead, Mignonette, Golden Queen, Golden Ball, Algiers; or (2) *light weights*.—Early curled Simpson, Grand Rapids forcing, Trianon self-folding, Wonderful, Nonsuch, and White heart.

Of Suttons' the following showed themselves *early*:—Ideal, Matchless, Nonsuch, White heart, White Golden ball and Early Paris:—of Dreer's, Trianon self-folding, Mignonette, Big Boston, Early Curled Simpson, Mammoth Salamander, Iceberg, Black-seeded Simpson.

Of Dreer's the following showed themselves late: Golden Queen, Improved Hanson, Grand Rapids forcing, Way-ahead, Hitinger's Belmont, California cream butter.

The cost of cultivation is very low as under: and a man can manage one fifth of an acre with ease.

Cost of cultivation for one tenth acre	$40.57
Gross yield per one tenth acre	60.00
Total net income	19.43

G. B. Deshmukh.

AN EXPERIMENT WITH SORGHUM VULGARE, THE GREAT MILLET OR JUAR, FROM THE BOMBAY PRESIDENCY.

The accompanying plate shows (behind the men who stand in it) a plot measuring 25 feet long by 10 feet, planted with millet at 12 by 12 inches in all directions. The smaller plants in front of the men do not belong to the plot. This millet, which is in ear, is a race raised from seed kindly supplied by Dr. Harold H. Mann, Director of Agriculture, Bombay, as one of the best of the district of Khandesh, its exact origin being the town of Jalgaon in the Tapti Valley. The seed was one of two lots received together, the other being from Ahmednagar, Bombay Presidency.

The two lots were sown in contiguous plots on 21st August 1919, the sowing being done by hand in shallow channels traced along the ground at one foot apart.

Three weeks after, thinning out took place, the pick of the thinned-out seedlings being transplanted to a second plot near by. These operations were both done on the same day for the two lots; and the transplanted plots were also contiguous. It may therefore be said that both races were raised under absolutely identical conditions of soil, of weather and of cultivation. Both races suffered in the same degree from the attacks of the sugar cane borer (*Chilo simplex*) which was found in almost every stem and also from "aphids" and from bird-depredation. Yet the difference of growth and of yield between the two varieties was very remarkable.

A, the Ahmednagar Sorghum ran to leaf: it grew to stems from 8 to 14 feet high, with abundance of leaves but the panicles so small (from 2 to 4 inches in length only) as to be of no account at all, so that as a cereal crop it was valueless, although as a fodder crop, it would have a value.

B, the Jalgaon sorghum, as shown in the photo, varied in height from 4 to 7 or 8 feet, with a full heavy and rather close, but not compact head of grain,* and altogether the crop, as a cereal may be said to be a very profitable one, as the figures below will show.

A fact worthy of notice is that this plant, from a region of India where the rainfall is a light one, has succeeded under very diverse conditions of climate.

Another point which deserves notice is that the plots which were planted from thinnings throve better than the plots raised direct from seed—a fact which upsets the dictum that Sorghum does not stand transplanting well.

The result of this first cutting was:

Sown plot, 142 stems were cut weighing, with leaves 31 pounds; the 142 panicles collected weighed 8¾ pounds, after two days drying that is to say that each panicle weighed dry, 1 ounce. The final result was 5 lb. dry grain.

Transplanted plot, 223 stems were cut weighing with leaves 102 pounds; the 223 panicles collected weighed 23¾ pounds, afer two days drying, that is to say that each panicle weighed dry 1.70 ounce. The final result was 15 lb. 5.03 oz. dry grain.

As previously stated, the whole crop was attacked by the sugar cane borer, which creeps through the stem and feeds on its substance; the damage done, however, was confined to a small portion of the stem below the seeding head, and, in no case, were the panicles damaged by it: the pest which is very easily traced by the red excretious which exude from its tunnel, was easily dealt with by injecting sulphur by means of a rubber puff into the hole, or by introducing a thin wire through the hole; this either forces it out or kills it.

The panicles themselves were damaged to a small extent by aphids, and by a small weevil, which however gave way after repeated dustings with sulphur.

Birds were the most serious enemies to this crop, and it took all the shouting and tin-beating of a small boy on the watch to keep them off. A very effective device to scare the birds away, a device put up by the coolie himself, was found to be the following:—

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* It is a rule in India that the Sorghums with very compact heads are grown in the wide plains where field joins on to field and there is no forest; while near forest such sorghums as may be grown are commonly those with open panicles. The Jalgaon Sorghum is of neither extreme; for with grains just touching, it combines fine pedicels under them. It has been thought that loose eared races are chosen by cultivators near forests because they are less subjected to bird depredation, but it may be said that they are also suited to a moister climate than the others.

The expanded skin of a flying-fox (after the body had been "scooped" out) was stretched to its full length of wing on a frame of bamboo, half rigid, half flexible, attached at both ends to the tips of the extended wings. The main bamboo, *i.e.* that which extends from tip to tip, is slightly bent, like a bow, so that, when taken hold of by the middle, and moved about, the wings, following the movement of the resilient bamboo, appear as if they were actually on the flight. The contrivance is attached at the top of a pole stuck in the middle of the field; a boy, in the distance, holds a string by which the pole is pulled: at the least tug, the bamboo bends and unbends, giving the skin a flying motion which scares the birds away—at least for a time.

Sorghum is one of the most important cereal crops of the world, its grain supplying a wholesome food which is largely consumed in all Asiatic countries. Estate coolies generally prefer it to "Ragi" (*Eleusine coracana*) over which it has the advantage that its grain can be cooked and eaten whole, whereas Ragi has to be ground into flour: it is also made into bread which is as nourishing as wheaten bread. It therefore commends itself particularly and strongly, at the time of rice and wheat shortage, to the attention of planters.

The returns of land under Sorghum cultivated as a pure crop, are variously given for India, as between 500 to 900 pounds of grain per acre (Watt's Dictionary, Mukerji, Macmillan). The seed in that country is generally drilled in rows 14 to 18 inches apart. The writer as already stated, had his seed sown in rows 12 inches apart, then thinned and transplanted at the same distances, viz: 12 inches by 12 inches.

Given a rich soil, the resulting crop appears to justify the practice of transplanting in this country and although it would be absurd to generalise from such small plots as are here in question, viz: 280 square feet, yet the amount of grain obtained was so much greater, (in the transplanted plot) than the averages given above for India, that it compels comment.

Reverting to the figures of yield previously stated, we found that 280 square feet of Jalgaon Sorghum planted 12 by 12 inches gave in one cutting, the following results:

Transplanted plot, 223 panicles weighing 23¾ pounds yielding 15 lb. 5.30 oz. of dry grain.

Sown plot, 142 panicles weighing 8¾ pounds yielding 5 lb. of dry grain.

The figures for the second cutting, which took place one week later on, by an unfortunate inadvertance, are not available. The panicles were, of course, much smaller, and the weight of grain obtained from them would have affected but slightly the final result. By neglecting them altogether, we shall strengthen our view that

Jalgaon Sorghum firstly may maintain its yielding capacity† under our local soil and climate conditions, secondly that transplanting increases the yield of grain.

Allowing for paths and computing one acre at 40,000 feet. we should come to the following figures:

Transplanted plot: 280 square feet 15 lbs. 5 ozs. of dry grain.

Sown plot: 280 square feet 5 lbs.

One acre—714 pounds dry grain.

In the light of the foregoing averages for India viz. 500 to 900 lb. per acre, the figure for the transplanted plot appears absolutely abnormal; but, then, so was the size and weight of the panicles. One, among the number, weighing 3¼ ounces was found after picking the seeds one by one, to give 2¼ ounces of seeds, the rachis weighing one ounce.

E. H. Mathieu.

A NOTE UPON PLANTS GROWN FOR BLUE DYES IN THE NORTH OF THE MALAY PENINSULA.

Within the last few years a little information has reached the Botanic Gardens upon plants raised in the north of the Peninsula for the sake of the blue dye that they yield; and three have been submitted for determination being:—

Indigofera suffruticosa, Mill.
Strobilanthes flaccidifolius, Nees, and
Marsdenia tinctoria, R. Br.

The first two of the three were sent from the state of Kelantan by Mr. R. J. Farrer, the latter two of the three from Upper Perak by Captain H. Berkeley. All three are well known as dye-plants; but as a dyeing industry flickers only within the Peninsula, it is interesting to ask what influence may have brought them into cultivation here.

Indigo cultivation has a long and a very complicated history; and the above named species of *Indigofera* is one only of half a dozen grown in different parts of the world. Indigo, almost certainly imported, was used as a dye in ancient Egypt; for mummy clothes of 2300 B.C. have been found dyed with it. It was prepared in ancient India, and finds mention in the sanskrit writings of about the same period. It was an expensive import of Rome at the commencement of the Christian era, coming from India via Alexandria, and bearing the name "indicum" from its source. It is extremely probable that Ancient Egypt also got its indigo from India.

† Misfortune attended an attempt to repeat this experiment; for rain fell heavily at harvest destroying the grain; and it is feared that the climate of Singapore in too unreliable for the crop; but in the north of the Peninsula if maturity be aimed at in February the chances of a return would appear good. I. H. Burkill.

With the sacking of Rome the use of indigo became lost to Europe; but without doubt India still grew it: and it can be shown that the Arabs who brought paper making into Europe and the sugar-cane, brought a knowledge of indigo cultivation at least into Asia minor. Europe, as it had always done in chief part, meanwhile went on using woad for its blue dye; but after a time a little indigo (now of Arabian origin) filtered afresh along the Mediterranean to Italy. And later when Vasco da Gama in 1516 had opened the way to India, the portuguese east indiamen began to bring indian indigo to the great mart of Lisbon. After the Great Armada had been destroyed, and with the ascendency of the Dutch which followed, the cultivation of indigo in Malabar and the Malayan region was encouraged; for trade in it was very remunerative, as for instance, in 1631 when five dutch merchant vessels brought from Batavia into Amsterdam 285 tons of indigo then worth as much as five tons of gold.

From this period dates the eclipse of woad in Europe, but not its extinction; for woad is still used to induce the dyeing with indigo.

Indigo growing even invaded Europe: for a century and more back its cultivation was tried with success in various places, *e.g.* Malta, Sicily, Southern Italy and Spain; and with passable results even in Southern France (department of Vaucluse): but it is certainly not a plant that can be grown economically now that the value it had has dropped to one quarter.

At least three species of *Indigofera* contributed to the early supply; for, while Surat indigo was derived from the cultivation of *Indigofera articulata*,, Gouan, the cultivation of indigo in South India would seem to have been of *Indigofera tinctoria*, Linn.: and in the Malay region the Dutch met with *I. sumatrana*, Gaertn., and they interchanged the two latter; they brought *I. tinctoria* to Malaya; while they took *I. sumatrana* to India: and *I. sumatrana* proving the better, they adopted it in both places. They spread it through Malabar and Madras; and when under the rule of the East India Company indigo began to be produced in Bengal, *I. sumatrana* was the species brought into cultivation around Calcutta, whence its cultivation was taken north to Rajshahi and then west to Behar, it becoming the plant of the well known Behar indigo industry. From this beginning for three quarters of a century Bengal went on cultivating the one species. *I. sumatrana*, which the Dutch had brought into southern India so long before.

Europe, however did not draw anything like the whole of its requirements of the dye from the East; but tapped (1) the West Indies and southern of the United States, where at the end of the 17th century *I. tinctoria* was the indigo grown, and (2) Brazil where an American species *I. suffruticosa*, Mill. (I. Anil, Linn.) was brought into cultivation. From the New World the latter found its way into the Malay region, and as the Dutch believed it better than *I. sumatrana* they changed their crop in Java; at the

same time this American *I. suffruticosa* got a footing upon the south coasts of China along with *I. tinctoria*, became also a crop of the neighbourhood of Manila, and would seem to have been the indigo grown by Chinese a little later upon the out-skirts of Singapore. And therefore to this date with this, the East had put four species under contribution.

The Arabs when they started the cultivation of indigo in Arabia took for their crop *I. articulata*—the species which supplied Surat indigo; and they established it also in Egypt; but this particular species did not spread to the upper Nile, where *I. arrecta*, Hochst., was or became grown. It may be that the origin of indigo-growing in Africa came from the Arabs; and in any case it is exceedingly probable that ancient Egypt drew its indigo from India and not from the Soudan; but the cultivation of *I. arrecta* has become very wide in Africa; and about 1860 the Dutch got possession of it for Java where it displaced *I. suffruticosa*, but did not hold its ground for long as a second American species. *I. guatemalensis*, Moc. and Sessé, came into favour about 1870, only to be ousted, imperfectly however, by *I. arrecta* coming in again as a consequence of changed methods.

These alterations of the species in vogue in Java, did not in Malaya extend beyond the Dutch Indies: but in India the Behar industry slowly began to follow suite in adopting *I. arrecta* under the name of "Java-Natal indigo."

Singapore gave up indigo-production in the seventies: the Philippine islands lost their export in the nineties: but China remains growing over a limited area on its south-east coasts for its own internal consumption, probably both *I. tinctoria* and *I. suffruticosa*. The last named is the species of *Indigofera* cultivated in Kelantan.

The indigo dye manufactured for the Chinese local markets is sold in paste: and such was that from this species sent by Mr. Farrer.

It is not possible to see a future in the industry, especially as the batik workers in Java who consume a considerable quantity of indigo appear to find the artificial more to their liking: and moreover Kelantan is backward in growing a species now twice superseded in Java—growing it moreover when the war had curtailed the supplies of artificial indigo.

The enormous demand for a blue dye in China is met but in part by the use of indigo: and indigo cultivation seems only to have got a hold in the south-east of the country: elsewhere the blue dye comes from *Isatis indigotica*, Fortune, the Chinese woad, from *Strobilanthes flaccidifolius*, Nees (Ruellia indigotica, Fortune), from *Peristrophe tinctoria*, Nees, and from *Polygonum tinctorium*, Lour. The second of these is the second of the dyes from the north of the Malay Peninsula with which we are dealing.

Strobilanthes flaccidifolius has never found a place in cultivation outside southern China, Indo-china and the adjoining moun-

tainous parts of India; but within its area it has quite an importance. It is for instance said in southern China to be prefered to indigo, both in the vat, and because instead of being a biennial it persists over several years and can be cut repeatedly. It is probably unsuited to the open plains where indigo is grown in India; and no one has had occasion to try growing it upon a plantation scale.

Obviously the Kelantan and Perak cultivation of this species is to be regarded as the southern limit of the range of this interesting crop. It would not be new in those parts, but like the Kedah rice fields, probably established from at any rate the time several centuries back when settled governments ruled between the mouths of the Irrawaddy and the China sea.

The third dye plant, *Marsdenia tinctoria*, R. Br., would seem to show a very different history. Its natural distribution is from the eastern Himalaya and southern China to Borneo and Java; but there is no history of its cultivation in northern India and China. It was first described at the end of the 18th century by William Marsden, who found it in western Sumatra and sent specimens to England when Robert Brown named the genus *Marsdenia* after him. It was brought to notice in Calcutta, and Roxburgh "warmly recommended an extensive cultivation" of it, after trying it in the East India Company's garden. But despite quite a considerable interest taken in it, which interest is very evident from the correspondence printed in the Journal of the Agri-Horticultural Society of India, no cultivation was taken up.

In 1844 it was shown that the Karens; and sometimes the Burmese of Lower Burma grow it: but it is said that they did not consider it the equal of *Strobilanthes flaccidifolius*. It appears to have been grown at one time in Java. Elsewhere it does not appear to have been a crop; and in no place so much a crop as in western Sumatra. Its cultivation therefore belongs to this part of the world in a greater measure than that of indigo and of *Strobilanthes flaccidifolius*.

Mr. Farrer describes the preparation of dye from *Strobilanthes* as done thus: the twigs are cut, steeped in water to which lime is added, the water beaten when fermentation has set in, and the precipitated dye subsequently collected. No oil is used, as Fortune says is in the tea districts of China.

I. H. Burkill.

ANOTHER "WET ROT," AND PORIA HYPOBRUNNEA.

About eighteen months ago an old tree of *Spathodea campanulata* that had been blown over in the edge of the Gardens' Jungle within the Botanic Gardens, Singapore, was cut at three feet from the base, and the stump being left in the ground was allowed to coppice. Some dozen strong shoots shot up; but when about

eight feet high they suddenly ceased growing, shed their leaves and died. The base of these coppice shoots at the crown of the old stump was examined and the wood was found to be permeated by yellowish brown lines exactly as in a case of *Poria hypobrunnea*. Upon examination of the stump lower down, the wood of the collar and root laterals was found to be soft and friable. The outer layers of the wood were deeply stained a yellow brown: and under the bark the hyphae of a fungus had collected into a dense felt-like ferruginous mass forming a plate two feet or more in length and up to a foot in breadth. Adjacent was a more advanced stage where the bark had fallen and a fructification forming a plate 16 inches by 12 was exposed. On other parts of the collar the hyphae had spread over the outside of the bark forming stout reddish strands which frequently cohered into narrow plates of hyphae.

The above description and the effect on the wood tallies in a great deal with Petch's description of *Poria hypobrunnea* but the fructification is entirely different. The fructification is resupinate, corky, of a ferruginous brown surface and content, rather darker in the older specimen, 1 mm. thick. The pores are of medium size and irregular, and the contents reduced to a very thin stratum. The setae of the pores are stout, sharp-pointed, 15 to 20 micromillimetres long. Spores are pear-shaped, with a small hyaline mucro, white, darkly opaque, smooth, 6 by 4 micromillimetres.

From the general appearance of the fructification the fungus is related to *Fomes pomaceus*, but its spores cannot be called hyaline. Apart from this factor it agrees with the description and comparison of *Fomes pomaceus*.

On a recent visit to Mr. G. E. Perry, Mycologist to the Société internationale de Plantations et de Finance de Caoutchouc, a specimen of *Poria hypobrunnea* and its effect on rubber trees were seen. Owing to the remarkable similarity of the above fungus except in fructification, and of its effect upon the wood, specimens were shown to Mr. Perry, who in reply forwarded the following note upon *Poria hypobrunnea*.

"*Porea hypobrunnea in Malaya.* In the past there has been considerable confusion between two root diseases attacking *Hevea brasiliensis*, *Poria hypobrunnea*, Petch, and *Poria hypolateritia* (now known as *Fomes pseudoferreus*). They were at one time even considered one and the same disease, even though the descriptions published by the Ceylon and F. M. S. scientists were at variance. *Fomes pseudoferreus* has been quite prevalent in Malaya, some estates being badly infected. The old name, *Poria*, is still used by the planting community for this saturated spongy condition of the roots, hence the confusion.

Through the kindness of Mr. T. Petch, Government Botanist and Mycologist, Ceylon, specimens of *Poria hypobrunnea*, were sent to this Department for our museum collection of disease specimens. This *Poria hypobrunnea*, Petch, which heretofore was not definitely known to exist in Malaya has since been found both in Selangor and

Perak. An infected stump sent in to this Department for examination exhibited unmistakable characteristics of the root disease. Further examination of the spot from which the tree had been removed, shewed more advanced stages of the infection on the few remaining laterals. On a recent visit to an estate in Perak, the writer found a similarly infected tree, the roots showing the characteristic red mycelial strands and plates adpressed to the surface. In the writer's belief, these are among the first instances of the disease being found and identified in Malaya.

A very good description of this disease was published in the *Tropical Agriculturist,* Vol. LII, No. 1 by Mr. Petch. He states in part that the appearance of the diseased roots is very variable and in consequence its diagnosis is in many cases difficult. On young trees its identification is fairly easy. The tap root then usually bears external mycelium in a more or less young stage and in that condition it is unmistakable. The mycelium forms stout red strands on the exterior of the root which sometimes unite into a continuous red sheet. The strands are smooth and tough on the outside and vary in colour from bright red to brownish red according to age. Frequently, adhering to the root, are found very small stones and fine gravel, but not so encrusted as with Brown rot disease. The appearance of the diseased wood is also typical in the case of young trees. It is somewhat soft and friable and permeated with red sheets. These sheets often run in cylinders in the wood along lines of the annual rings. On older trees the indications are by no means so clear. The roots which have been longest diseased are generally soft and wet and on these there may be a net work of narrow white threads between the bark and the wood. The fructification may sometimes be found at the collar of the diseased tree, or along the underside of exposed lateral roots. It forms a flat plate closely applied to the surface of the root or stem. At first it is yellowish white; it then changes to reddish brown and finally to a dark slate colour. Its thickness is usually about one and a half millimeters and it may spread over an area of several inches.

There is no doubt that the disease spread originally from jungle stumps. Its recent appearance on rubber estates, about twelve years old, where it was not previously known, is probably to be attributed to the way in which the thinning out was done. It had been found to develop from the stumps of the felled *Hevea,* where the trees were cut down to ground level and the stumps left to decay, and is one of the most regular frequenters of rotting *Hevea* logs. The spread from tree to tree is usually by direct contact of the roots: however it has been demonstrated that the mycelium of this fungus can travel from the diseased roots for some little distance through the soil. With regard to the rate at which the disease progresses, the following may be noted:—*Hevea* was planted on newly cleared land in June 1913; the trees began to die in 1914: that is quite as rapid as any other root disease.

The treatment of *Poria hypobrunnea* follows the usual lines, but it is especially necessary that all *Hevea* logs should be removed as the fungus develops chiefly on them.

The recent appearance of this disease in Malaya should not be viewed with alarm, as in all probability it has been prevalent for some time, but until now has not been identified as *Poria hypobrunnea.*"

It would appear that the symptoms are caused by even more than the two fungi mentioned,* *Poria hypobrunnea* and *Fomes pseudoferreus*, although the present record is not from a Para rubber tree, but from another tree, exotic in Malaya, but not a native of the continent which has furnished the Para rubber tree to Malaya.

T. F. Chipp.

THE MELON FLY, BACTROCERA CUCURBITAE.

The melon fly, *Bactrocera cucurbitae,* found its way into the Hawaiian islands in 1895 and there did such serious damage, that Melon growing became impossible. To combat it, the Board of Agriculture and Forestry for Hawaii, sent their Entomologist Mr. David T. Fullaway, to the East in 1917 to seek for insects that prey upon the fly. In the course of his tour he visited Singapore, and soon located Bactrocera near the town in a Chinese vegetable garden; and by breeding out the insects he obtained three individuals of a parasite of the genus *Opius.* This was a first step on the road: but he got no more though he reared in captivity 6000 of the flies. Proceeding to Java he found the same *Opius* on the melon fly, and in slightly larger numbers: later on reaching India he got it again about Bangalore. This parasite, *Opius fletcheri,* he conveyed to the Hawaiian islands and turned loose in the neighbourhood of Honolulu. It has done its work to such an extent that in the "Hawaiian Forester and Agriculturist" for April 1920. Mr. Fullaway reports it to destroy 50% of the melon flies, and that "it is again possible to grow melons successfully."

It is very probable that the melon fly is the limiting factor to Melon cultivation in the Straits Settlements: and the occasional successes with melons that reward enterprising people are in that case chiefly due to the Melons being grown out of reach of the fly. Its connection with wild gourds has not been studied.

I. H. Burkill.

THE COHUNE NUT.

The recent fruiting of the Cohune palm, believed to be its first in the Malay Peninsula, calls for more than a bald record.

With this object in view the following notes have been prepared and give (1) a short description of the plant, (2) its native habitat (3) its uses, so far known, (4) the results of analysis of the

Cf. Belgrave, A wet of rot Para Rubber Roots, in Department of Agriculture, F. M. S., Bulletin No. 28.

Nut and difficulties in oil extraction, (5) its possibilities. The plants mentioned above, as having fruited, are situated for the most part in the Botanic Gardens, Singapore; but two of a row of four plants in front of the Raffles Museum, Singapore, have also fruited. These plants are all about the same height and were probably raised from one particular batch of seeds, several consignments of which have been received and successfully raised at the Botanic Gardens, at various times. In view of this it can be safely assumed that all the plants now fruiting are of the same age. No record has been found to indicate the exact age of the trees, but as a result of careful enquiries it has been established beyond doubt, that they are from 25 to 30 years old. Care has been taken to avoid understating the age, in order that experiments from a commercial point of view, should not be attempted under a misapprehension as to the length of time which must elapse between the time of sowing the seed and the fruiting period.

Up to the latter of part of 1918, the plants of *Attalea Cohune* in the Botanic Gardens, Peradeniya, Ceylon had not produced fruits.

General Description of the Palm.

Attalea Cohune, Mart.—the Cohune Nut Palm. A magnificent feather-leaved palm which attains a height of about 40 feet. In the ordinary way the old leaves are cut off and the leaf bases remain on the stem giving it a very rugged appearance. These leaf bases afford a firm footing for ferns, etc., which when established are very ornamental and in the Botanic Garden the palms are so kept. When the leaf bases are thus allowed to remain the stem takes on quite a distinctive shape At the base it is from 1-2 feet through and gradually thickens upward until at the crown it becomes fully 4-6 feet through. The effect thus produced is certainly striking as the stem is three times thicker at the top than at the bottom. In a specimen from which the leaf bases have been removed the trunk is smooth and cylindrical, there being little difference in size the whole way up. The leaves are produced abundantly at the top of the trunk, are fully 20 feet in length and form a magnificent crown. The pinnae are placed close together on the rhachis and are held more or less rigidly at right angles to it, thus giving a flat surface to the leaf. The leaf becomes twisted at a short distance from the base with the result that the pinnae of the upper three quarters of it have their edges towards the light instead of their faces, as in the older leaves of the majority of the palms. Also, about two thirds of the way up, the rhachis makes another bend, producing a very gracefully curved upper part to the leaf. The inflorescences are produced in the axils of the leaves in fair quantity and are at first enclosed in large tough fibrous spathes from 5 to 6 feet long and ¼ inch in thickness. These latter are more or less boat shaped and extend at the apices into horn like structures about two inches in length. They soon split longitudinally on the upper surface and remain during the flowering and part of the fruiting period. Apparently they play

a dual role, at first that of enclosing the tender spadices and later when open protecting them from rain. The spadix is almost the same length as the spathe and bears numerous simple branches, arranged more or less spirally, the longest of which does not exceed 1 foot. The peduncle is about 2 inches thick, is somewhat flattened and the upper half only bears the flowering branches. The latter are more or less uniform in length and are quite thin. Flowers are produced in large quantities on the spadix and are yellowish in colour. Sometimes a spadix bears either all male or else all female flowers, in which case the spadix is dioecious: and sometimes a spadix produces separately both male and female flowers, in which case it is monoecious. Occasionally a few hermaphrodite flowers make their appearance. The male flowers are considerably smaller than the females and in monoecious spathes are borne on the upper parts of the spadix-branches while the female flowers are borne on the lower parts. The fruit is ovoid and large being about 2½ inches long and proportionately broad. A small projection occurs at the apex which originally bore the stigmas of the female flowers: the outer skin or pericarp is fibrous and woody, while the inner skin or endocarp is very hard and bony. These enclose the seed or nut which contains an oil of considerable value.

Habitat. The native habitat of this palm is in tropical America: in British Honduras, it covers huge areas in the form of a natural stand. It is found in low lying parts and produces enormous quantities of fruits.

Uses. So far the palm has not been put to any extensive use. Beyond its local uses it does not yet rank in importance with its relatives the Coconut and Oil Palm. A note in the Annals of Botany XII p. 165, mentions the use of the Cohune Nut in the coagulation of rubber. By exposing a thin layer of Para or Ceara latex to the action of the smoke from the burning shells coagulation is immediately brought about. In this case the species mentioned is *Attalea excelsa*: but doubtless *Attalea Cohune* can serve the same purpose.

The following is an extract from the Gardeners' Chronicle (LXVIII. 1920, p. 211) and seems worthy of repetition for the peep behind the scenes and because it emphasises the important part which science played in the Great War.

"*Attalea Cohune*—the hard shell of the Cohune Nut of Honduras, the fruit of the Manaca Palm, was found when carbonised to give protection against poison gases in the war."

Results of an Analysis of the Nut and the Difficulties in Oil Extraction.

A careful analysis of the seeds has been made at the Imperial Institute and the results are recorded in the Bulletin of the Imperial Institute (1913). The conclusion arrived at is that as an oil palm *Attalea Cohune* is a very valuable plant. The analysis showed that "Cohune kernels" yield about the same per-

centage of fat as copra and rather more than palm kernels and it is considered that in the market, the oil should fetch about the same price as coconut oil and palm oil.

There are certain difficulties in dealing successfully with it, the chief of which are (1) the exceptionally hard nut which necessitates special crushing apparatus and (2) that experiments with mechanical crushing show that the kernels bruise very easily and during transit to any distance the oil in them becomes rancid. The latter is under further investigation and it is probable that the difficulties will be overcome successfully in the near future.

Possibilities. The possibility of the palm ever being of any economic value in this country seems improbable, owing to the length of time needed before the plant becomes sufficiently mature to produce fruits. When once this stage has been reached the yield seems fairly regular and no doubt on a large area sufficient fruits could be obtained to make it a paying concern. Until it can be made to produce fruits at an earlier age it is of no value in Malaya. It seems to be a subject for further investigation and if data could be obtained from British Honduras dealing with yield and age, the question could quickly be settled as to whether it would be worth while experimenting with a view to shortening the period needed for fructification or not worth while.

The note dealing with the use of Attalea nuts in the coagulation of rubber, points to two possibilities:—(1) the extraction of oil from the kernels and (2) the use of the hard shell for coagulating rubber, provided *Attalea Cohune* and *Hevea brasiliensis* could profitably be grown in close proximity. The latter point is open to criticism in that a certain amount of oil of an inferior quality can be extracted from the shells and with the mechanical problems solved no doubt this would be extracted and placed on the market. Which of these two procedures would be most profitable it is not possible to state and can only be determined by actual experiment. It may be mentioned in passing that as *Attalea Cohune* grows in low lying land, there would appear to be a use for the low-lying swampy portions of land often found on estates and which are put to no practical use. This however, all depends upon the question of shortening the period between the sowing of the seed and the fruiting stage, so far as Malaya is concerned.

F. Flippance.

THE BRAZIL-NUT TREE IN SINGAPORE.

In 1911 Mr. W. J. Young, discussed the Brazil nut in the Pomona College Journal of Economic Botany, 1, pp. 122-134, and came to conclusions which are questionable. It is convenient to introduce the subject in his own opening sentences. "The genus, *Bertholletia*, to which is assigned the Brazil-nut of commerce, was

established in 1808 by Humboldt and Bonpland, who placed in it a single species. *B. excelsa*. A translation of Bonpland's description of the fruit of this species follows.

Fruit a spherical compound nut of the size of a child's head and often larger, divided internally into four cells each of which encloses several nuts; covered on its exterior with a husk of green colour, smooth and shining.

Main nut very solid, rough and marked by the branching furrows on its outer surface, 6 lines (1 cm.) thick, divided internally into four cells by as many membranous dissepiments which become obliterated in part or entirely after the maturity of the fruit but of which there always remain traces.

The tree is described as 33 m. high (110 ft.) with a trunk 9 dm. (3 ft) in diameter. Leaves alternate, oblong, subcoriaceous, 1 dm. (4 in.) broad and 6 dm. (23½ in.) long, borne on short petioles. Type locality. Rio Orinoco.

On account of the great height of the trees these botanists were unable to obtain the blossoms although it is said that they offered in vain an ounce of gold for specimens. On this account they were uncertain as to the position which the genus *Bertholletia* should occupy in the vegetable kingdom."

In 1855, Berg, monographing the Brazilian Myrtaceae within which order the genus *Bertholletia* falls, gave a new description, which Miers (Trans. Linn, Society, London, Vol. XXX, 1873, pp. 161) was quick to see diverged from Bonpland's and Humboldt's. Thereon, he made two species. *B. excelsa,* Humb. and Bonpl. and *B. nobilis,* Miers, the latter being *B. excelsa,* Berg.

He followed the first authors and ascribed the origin of the Brazil-nut of commerce to *B. excelsa* rather than to *B. nobilis.*

But in 1911 Mr. W. J. Young (in the Botanical Gazette, lii. pp. 226-231, and in the Pomona College Journal of Economic Botany. pp. 122-127—I have only seen the latter), from an examination of consignments, at the United States ports, of fruits, declared Miers wrong and that *B. nobilis* is the origin of the Brazil-nut of commerce; he states:—

"Commercial samples of Brazil-nuts contain in larger or smaller numbers, opercula derived from the fruit and the presence of these in itself is evidence that the nuts were derived from *B. nobilis,* since as had been noted (earlier in his paper), the operecula fall from the mature pyxidia of *B. excelsa* and hence would not find their way into the sample of nuts from that source. On the other hand their presence in the nuts from *B. nobilis* is perfectly normal and what would be expected since in this species the opercula fall into the interior of the pyxidia and become mixed with the nuts. They vary in form from ovoidal bodies to cones of varying slope and all provided with a distinct apical point.

Every pyxidium of the Brazil-nut the writer has examined, has indicated that the fruit is that of *B. nobilis.* Their main

points of structure are well shown in the figures.....which illustrate pyxidia obtained from different sources. Comparisons of the photographs with Miers description of *B. nobilis* will leave no doubt of their identity. Most, if not all, of the pyxidia which the writer has examined were brought to this country by the importers of Brazil-nuts and represent the source of the nuts in which they deal."

In 1914, Dr. T. Petch, in the *Annals of the Royal Botanic Gardens, Peradeniya*, V. pp. 421-431, as a result of study of a living tree controverted Young's statements, concluding thus:—

"It is evident that the Peradeniya tree in many respects combines the characters of the two species. The foliage is that of *excelsa*, and the shape of the pyxidium is that of *excelsa*, though the opercular openings are those of *B. nobilis*."

On the whole, though conclusions based on a single tree can scarcely be regarded as valid, it would appear that this Peradeniya tree affords strong ground for the suggestion that there is, after all only one species of *Bertholletia*."

It is proposed here to give the results of an examination of the trees in the Economic Garden, Singapore, chiefly of the two older trees.

The Ceylon plant was introduced from Kew, in 1880: in 1881, Singapore received plants also from Kew: a common origin of the older trees is, therefore, possible. Observations on the two older Singapore trees are below. The third and younger tree would have a different origin.

In the Singapore trees the characters assigned as identification marks to Miers' two species are mixed and the proportion of characters said to belong to *B. nobilis* are to those said to belong to *B. excelsa* as 8: 5.

From the examination of the fruits only, upon which Mr. Young has relied, our trees will fall into the species. *B. nobilis* and not into the species *B. excelsa*: but from other marks the conclusion holds that there is only one species.

Summary of the Characters.

1.	Height: diameter ratio:: 36.4:1; 47.3:1; 42.5:1.	excelsa.
2.	Trunk bare up to about (1) 25 feet; (2) 30 feet; the third tree 10 feet	nobilis.
3.	Leaves dark green when old, young *rufescent*	nobilis and excelsa.
4.	Petiole is up to 28 mm. long	excelsa.
5.	Panicles 10.5 inches long, with 3-6 side branches horizontal and then becoming parallel	nobilis.
6.	Floral nodes 0.5 inch. apart	nobilis.

7.	(*a*) Pyxidium globose	nobilis.
	(*b*) Pyxidium elongated	excelsa.
	(diameter of the fruit according to the size of the fruit)	
8.	Cortex of the fruit rough, thick and much lenticellated	nobilis.
9.	Opercular opening small, widening considerably inwards; or with nearly straight walls narrowing slightly at the inner end ..	Mixed excelsa and nobilis.
10.	(*a*) Operculum conical with a sharp point; (*b*) Operculum cylindrical flattened at the top	Mixed excelsa and nobilis.
11.	Calyx tridentate	excelsa.
12.	Cortex of the fruit cracks but does not peel off if the fruit is handled	Mixed excelsa and nobilis.
13.	Operculum falls into the cavity of the fruit	nobilis.
14.	Cavity of the fruit unicellular on withering of the septa	nobilis.

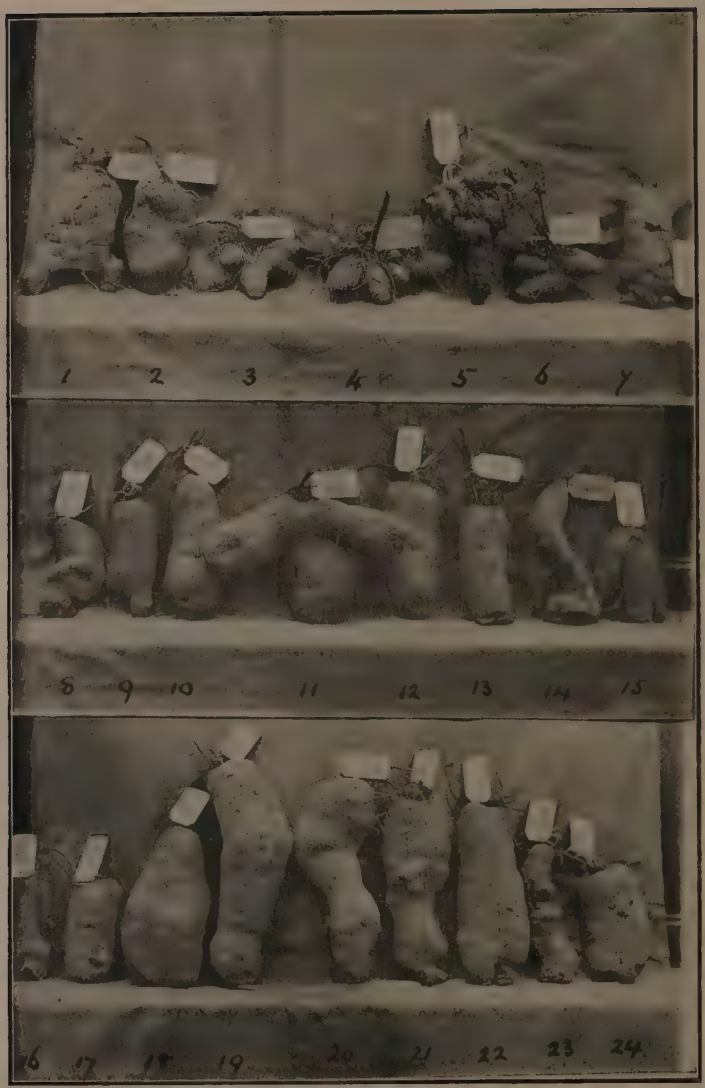
G. B. Deshmukh.

THE CORRECT BOTANIC NAMES FOR THE WHITE AND THE YELLOW GUINEA YAMS.

In the Gardens' Bulletin (this volume No. 3, 1918, pp. 87-91) short notes were given upon the above named two West African Dioscoreas, being important foods of many millions of Negroes. In it the identity of the second with *Dioscorea cayenensis* was stated; but no latin name was used for the first; and the purpose of returning to the subject here is to suggest that it is *D. rotundata*, Poiret (Encyclopédie méthodique, supplement, vol. III, 1813, p. 139). *D. rotundata* was described upon a specimen from the New World: but that Poiret could arrive at describing an African plant as West Indian is very easily understood.

The White Guinea Yam is grown in West Africa from Sierra Leone to Angola in great quantities. It is in the ground for eight months of the year, at the end of which period the dug tubers are stored in racks in the villages for consumption as long as they can be got to rest.

Having a wide area and great importance, it is raised in a considerable number of races, nineteen of which, grown in Nigeria, are figured here from photographs taken by Mr. J. Hutchinson of the Royal Botanic Gardens, Kew. Some of these races are earlier than others, and used for prolonging the season; some are more palatable: some heavier yielders, etc.: but of their qualities at present indications only are available.



NIGERIAN YAMS.

Plate XXVI.—Nigerian Yams.

1 OLOTUN IYAGBA (White Guinea Yam)

2 EFIAN (Yellow Guinea Yam)

3 EBA EDI (Dioscorea dumetorum)

4 OBUBIT IWA (Dioscorea dumetorum)

5 AKPANA (Dioscorea dumetorum)

6 NDISIME IWA (Yellow Guinea Yam)

7 SAJA (White Guinea Yam)

Upper Row.

8 AGOGO

9 AFIA OKO

10 OKPO UMAN

11 IHOBIA

12 OLOFERE

13 ALAOKO

14 OTUK OKPO

15 AGA

Middle Row, all the White Guinea Yam.

16 OKO

17 OKPURU

18 KANGE OJINLAJA

19 LAYINBO

20 AGAKE

21 IGUN

22 DODORO

23 NDIAHI

24 OLONKO

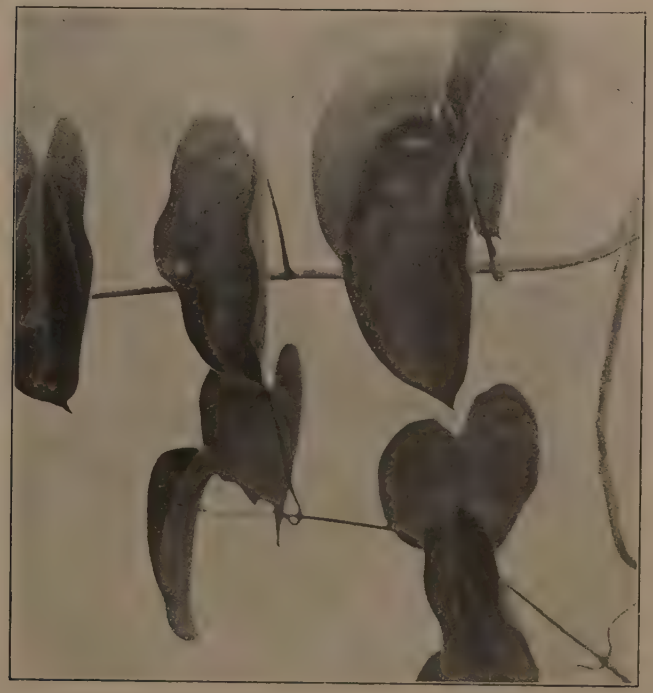
Lower Row, all the White Guinea Yam.

In the wetter regions of the Nigerian coast and adjacent parts, the Yellow Guinea Yam gets some of the importance of the White Guinea Yam; because as it grows through the whole year, never resting, it is peculiarly suited to those equitable parts, and the tubers can to a certain extent be dug as wanted. These tubers will not keep. It has not got the same great number of races that the White Guinea yam has.

Both the White and the Yellow Guinea yams were early taken to the New World, as also was the Indian *D. alata*,—whether for the first time independently of the slave trade, or in the course of that trade cannot now be ascertained: but this is well attested, that yams were shipped with the negroes as provisions for the voyage whether to Lisbon for proceeding thence to America or to America direct: and among the various names applied to them in the West Indies to this day are certain distinctly reminiscent of the custom, such as Negro Yam, Guinea Yam and Lisbon Yam. The proper application of these names would seem to be, Negro Yam to the White Guinea Yam, Guinea Yam to the Yellow Guinea Yam, and Lisbon Yam to certain races of *D. alata*, but there are inconsistencies in modern usage. The last named was probably in West Africa before it was in America, for Marcgraf writing in 1648 called it the Inhame de S. Thomé or Yam of St. Thomas' island, the said island being off the Gaboon coast.

Because of their keeping qualities, the White Guinea Yam and *D. alata* were better for provisioning ships than the Yellow Guinea yam; but the last had the advantage of being available almost through the year. The three kept a proportionate importance in the West Indies, and nothing could be more natural than that botanists should make acquaintance with them, though two are African, in America. Thus it happened that Lamarck in 1789 described the Yellow Guinea Yam from Guiana under the name of *Dioscorea cayenensis*, and Poiret in 1813 described from a West Indian specimen a *D. rotundata*, which as far as his inadequate material and incomplete description show, can be considered as the White Guinea Yam. The description not sufficing for a clear understanding, Grisebach in his *Flora of the British West Indies*, 1864, p. 587, set down the latter as a variety of the former, a place which it has occupied since, and in which Sir David Prain and the writer left it, when discussing in the *Kew Bulletin* 1919, p. 364, *Dioscorea sativa*. But subsequently the photographs here reproduced, of types of both names, as they exist in Desfontaines' herbarium,, were obtained, and in correspondence between Professor E. Chiovenda, who has charge of that Herbarium, Sir David Prain and the writer, the conclusions have been reached that Poiret had before him a branch of the White Guinea Yam when he drew up his description of *D. rotundata*, and that therefore, no older name existing, the White Guinea Yam is to be so called.

The identity of the Yellow Guinea Yam with *D. cayenensis*, Lamk., has been asserted already by Dr. August Chevalier in the *Bulletin de la Société botanique de France*, IX. 48, fig. 3 bis, where



The folded foliage of the White Guinea Yam.

The flatter foliage of the Yellow Guinea Yam.

DIOSCOREA ROTUNDATA, POIRET (*on the left*), and D. CAYENENSIS, LAMARCK (*on the right*),
as represented in Desfontaines' herbarium at Florence.

is a picture of a type existing in Lamarck's own herbarium. Those who have access to that portrait will observe how closely it corresponds with the portrait here given.

Lastly as a contribution to the better understanding of the two species a third plate is added here showing the distinctive pose of their leaves.

I. H. Burkill.

HIBISCUS SABDARIFFA, VAR., ALTISSIMA.

In the Gardens' Bulletin opposite p. 244 of part 7 of this volume *Hibiscus Sabdariffa*, var., *altissima* was illustrated; and the remark was made on p. 243 that the fruits are too small and on account of their hairs little suited for making jams and jellies.

The variety is indeed a fibre plant and not a food plant, and as such should be experimented with in this country. At a recent date its fibre offered on the London market as Bimlipatam jute was worth £45 per ton.

Bimlipatam is a small port in the Madras presidency just south of the great Bengal jute area, where *Hibiscus cannabinus* is the local fibre plant and is grown plentifully in lines among other crops, retted and the fibre marketed. The fibre is slightly stronger than jute, but because the supply is used up along with jute gets the same price as the first marks of jute.

Hibiscus Sabdariffa being a species closely allied to *H. cannabinus*, it is not surprising to find in its tall variety *altissima* characters as to fibre which are common to both: and excellent fibre has been prepared in the Economic Garden, Singapore, by Mr. Mathieu, and valued in London, by the kindness of Professor W. R. Dunstan, at the figure above. The process used was retting.

I. H. Burkill.

ORCHID NOTES.

Bulbophyllum limbatum, Lindl.

In 1840 Lindley described as *Bulbophyllum limbatum* a small orchid which had been grown in Messrs. Loddiges' horticultural establishment at Hackney, near London. He recorded its origin as Singapore: and at the same place (*Botanical Register*, XXVI. 1840, Misc. p .74) he described several other orchids from Singapore to which the further record is added that they were "received from Mr. Cuming." These others are all well-known to grow wild in Singapore: but *B. limbatum* had not been seen again until last year.

Hugh Cuming was a great collector, who visited our coasts upon his way to and from the Philippine islands in 1835 and 1839. Although it is not expressly stated in the *Botanical Register*, it is

almost certain that it was he who took the *Bulbophyllum* to Britain; and as the other orchids are all species found locally in Singapore, the probability is that the Singapore forests and not the Singapore port, furnished it. The new locality at which it has been obtained is Kotah Tinggi in Johore, and the finder Mr. H. Leu Jeppesen, of the Mount Austin Estate.

Lindley's description, slightly modified, appears in Sir Joseph Hooker's *Flora of British India*, V. 1890, p. 763. and in Mr. H. N. Ridley's *Materials for a Flora of the Malay Peninsula, Monocotyledons*, I. 1908, p. 69. It is now possible to add to it.

The pseudobulbs were described from dried material by Sir Joseph Hooker as depressed subglobose: they are when fresh obturbinate. The leaf which has not been described is almost narrowly elliptic, being by but a little more rapidly narrowed below than above; it is 9 cm. long by 2 cm. wide, solitary, on a petiole 1 cm. long. The inflorescence may exceed the four inches of Lindley's description, and be 15 cm. long: upon it Mr. Jeppersen has seen as many as 12 flowers. The flowers give the impression of being of a dark claret colour; in detail they are thus. The centre within about the base of the column and of the petals is chrome yellow; this becomes paler outwards and tinged with lake on the sepals and petals under their purplish-chocolate margin. The dorsal sepal has three relatively wide purplish chocolate bands down it, which become somewhat interrupted towards its base; and the lateral sepals have five. Their margins are finely pubescent. The petals have one band running into the margin: they are half as long as the sepals. The lip is liver-coloured, paler below upon a triangular margined area with its base the hinge; this area has microscopic purple spots: there is a margined narrow groove on the upper surface extending nearly to the tip, with a chocolate border at the base. Seen from below the lip is elliptic-ovate; from the side it looks exactly like an ox-tongue in the same position; from above the groove makes it subcordate: it all but equals the sepals, and is distinctly mobile. The horns of the column project upon either side of the anther in the same plane as the column.

Eulophia macrostachya, Lindl.

Eulophia macrostachya, Lindl., is an addition to the Flora of the Malay Peninsula. Though an orchid of unusually wide distribution, it had remained unknown as occurring in the Peninsula until last year. It was found on a limestone hill near Sungei Siput, in Perak, and was brought into the Botanic Gardens in Singapore where it flowered in October.

In 1919 it was received in the Gardens from the Tambilan islands which are between Singapore and Borneo: and it is known to occur in Ceylon, up to 4,000 feet, in Travancore and in the Nilgiri hills, in Sumatra, Java, Ternate, Mindanao and Leyte. In 1889 a plant of it of unknown origin flowered in the Singapore Gardens.

Spathoglottis affinis, de Vriese.

Spathoglottis affinis, de Vr., is a second addition to the Flora of the Peninsula. This beautiful little terrestrial orchid, hitherto known only from the mountains of Salak and Tegal in Java, was found in 1919 by Mr. Mohamed Haniff on Kedah Peak, and has since flowered freely in the Waterfall Gardens, Penang.

The specimens were referred to Dr. J. J. Smith of Buitenzorg for confirmation of the name, and he writes that he regards it as correctly named *S. affinis*, but that the side lobes and the claw of the midlobe are much narrower than in the Javanese plant, and that the callus too is thinner.

Acanthephippium sylhetense, Lindl.

In the Gardens' Bulletin II, No. 2, 1918, p. 44, the genus *Acanthephippium* was added to the flora of the Malay Peninsula; since when a second species has been found south of the isthmus of Kra,—this one in the Siamese Malay States. The second species is *A. sylhetense*. Lindl., which was brought alive into the Waterfall Gardens, Penang, by Mr. Mahomed Haniff from Bukit Khaw Poh near Kasum.

The flowers of the plant from Siam are few, and just before opening they are 1½ inches long from the tip to the base of the bucket, with a maximum width of ⅝ of an inch. They are creamy white with yellowish lines where the sepals meet. They commence their opening, by splitting between the lateral sepals, and then give off a faint pleasant scent. The tip of the labellum can be seen in the opening. With further expansion the lateral sepals become obliquely revolute making with each other a wide V. The petals outgrow the dorsal sepal and stand forward beyond it slightly. The free parts of the sepals and petals are minutely dotted with a pink, which on the inside of the lateral sepals is somewhat collected into five bands, the lowest (nearest to the line of contact between the two sepals and so under the labellum) being very faint. The labellum has the inverted saddle shape so characteristic of the genus; the side lobes which make the side flaps being of a flattened axe-shape, the midlobe is tongue-shaped and curves downwards. It is of a clear buttercup yellow, and so is the part of the limb behind it, where are three crests, the lateral double toothed at the back. The rest of the inside of the flower is creamy white, except that it is suffused with yellow in the base of the bucket.

Lindley's description of *A. sylhetense* says that it is inodorous, gives the flowers a slightly greater size, and mentions no colour but white. But he himself later united Griffith's *A. ringiflorum* to his *A. sylhetense*; and Griffith says of *A. ringiflorum* that the white sepals and petals are spotted within with reddish purple, particularly towards their apices and that the linear concave stalk of the labellum is yellowish as also the mid lobe of the lip, which characters are found in the Siamese specimen. Griffith says that there are 5

crests on the labellum, 2 confluent; such a view is quite reconcilable with the one saying that there are 3 crests, the latter with two teeth at the back.

Gastrodia malayana, Ridl.

Gastrodia malayana,—an interesting leafless orchid has been found newly in Penang by Mr. Mohamed Haniff in a specimen 32 inches high. Such a height is far in excess of what it is known to reach in Singapore and neighbouring parts of the State of Johor.

I. H. Burkill.

NOTES.

A possible ancient migration of useful plants Westward in Asia.

In a very interesting account of "The origin and ethnological significance of Indian boat designs" (*Memoirs Asiatic Soc. Bengal*, VII. 1920, p. 139-256) Mr. James Howell suggests that a boat-using community once occupied the coasts of Southern India which was of Negrito stock, and this was followed by a proto-Polynesian stock, and then by the Malaysian wave which reached Madagascar. Later the Dravidians came into Southern India and Ceylon from the Mediterranean by land, and completely absorbed the sea-going people whom they found already there.

These suggestions are worth remembering in connection with the migration of useful plants: the coconut for instance may have reached India by the agency of the second stock.

Under-sea Meadows.

Professor W. A. Herdman's remarks in the Journal of the Linnean Society of London, Zoology, XXXIV, 1920, pp. 256-258, upon the great economic value of the seaweed meadows of the Irish Sea are most interesting. Firstly he touches upon the zone of the Brown Seaweeds, concluding "that a very large amount of organic food must be present" in it, and "it is not surprising that shoals of young fish are found feeding there." In the second place he turns to the green Grass Wrack (*Zostera marina*) which lives on muddy sand up to high water mark. The Zostera bed, says Professor Herdman, is an important source of food to fishes and invertebrate animals, "its waving forest, clothed with many other organisms, large and small, is one of the densest masses of living plant food.....in the sea, both directly from the food that it furnishes to the animals living in it, and indirectly from the enormous quantities of Diatoms which cover its decaying leaves."

In the seas of Malaya the brown seaweeds are unimportant: but not so the undersea meadows of the tropical Grass-wrack, *Enhalus*,

whose large loose meadows are the grazing grounds of the Duyong, and are frequented by we scarcely know what fish. In the study of them, the sea offers a wide and a most interesting field.

The size of a first class Botanic Garden.

Very interesting is the evidence taken by a Committee (the Joint Committee on the Library, Congress of the United States) on the proposal to establish in Washington a National Botanic Garden. The Committee meeting on May 21st, 1920, heard a number of eminent men, the second to give evidence having been Dr. N. L. Britton, Director in chief of the New York Botanic Garden:—

Senator Knox. "I would like to ask.....what would your judgment be as to an adequate area for a botanical garden such as the United States ought to maintain here at the Capital?"

Dr. Britton. "I should think you ought to have at the minimum four or five hundred acres. You ought to have that to develop an institution which would meet the necessities.

Senator Knox. What is the area of the New York Garden?

Dr. Britton. We have about 394 acres.

All the other witnesses supported the idea of obtaining an area of 400 acres: and as matters are reported it appears as if the proposal will go through.

The evidence ends with a review of the Gardens of the world, showing Germany to possess 36, Italy 23, France 20, Russia 16, the United Kingdom 14, Austria-Hungary 13, the United States 12, and so on: but the whole British Empire contains 65. The size of the Gardens and some account of them follows. The new Botanic Garden at Kirstenbosch, Cape Town is credited with 400 acres, Kew with 288, Calcutta with 272, and several with 200. From that they descend until with the purely University Gardens we arrive at some of very small size.

A Botanic Reserve—Mount Maquiling.

The Government of the Philippine Islands has set aside Mount Maquiling, in the island of Luzon as a national reserve: it is to be kept for the students of animal and plant life, for those who wish to study the Fauna and Flora. The mountain is 1144 metres high (3753 feet); and is covered with virgin forest through which a few paths have been cut. At its foot are the laboratories of the College of Agriculture of Los Banos, and it is intended that one use of the reserve shall be for the training of foresters.

RAINFALL.

at the Director's house, Botanic Gardens, Singapore, during the first half of the year 1920.

Readings taken always at 8 a.m. and credited to the date in which the twenty-four hours begin. Measurements in inches.

Date	January.	Feb.	March.	April.	May.	June.
1	3.65	0.43	...	...	0.10	Trace
2	1.65	...	...	Trace	...	...
3	3.82	...	0.61	...	0·14	...
4	0.18	...	0.16	...	0.21	...
5	0.08	...	0.14	..	0.20	...
6	0.02	0.03	2.02	Trace	0.01	...
7	Trace	0.02	0.05	...	...	...
8	0.40	0.15	...	0.72	...	0.96
9	Trace	0.01	...	Trace	...	0.07
10	...	...	...	...	1.03	0.02
11	0.60	...	...	Trace	0.72	1.27
12	0.65	...	Trace	Trace	...	...
13	...	...	..	...	0.72	...
14	Trace	Trace	...	0.34	0.86	...
15	...	...	8.85	0.15	0.02	0.40
16	...	1.65	Trace	...	Trace	0.02
17	...	...	Trace	Trace	...	0.03
18	...	...	1.12	0.34	...	0·05
19	2.34	...	Trace	0.35	...	0.03
20	Trace	0.15	0.84	0.07	...	0.03
21	0.17	0.50	0.05	...	...	...
22	Trace	0.03	0.23	Trace	0.11	...
23	...	1.59	0.35	0.05	0.41	...
24	...	Trace	...	Trace	1.31	0.46
25	...	1.02	0.23	0.09	...	0.28
26	0.10	Trace	0.63	...	Trace	...
27	...	1.26	0.05	0.09	...	...
28	0.40	0.42	0.08	Trace	...	...
29	...	0.02	...	...	Trace	...
30	...		...	1.48	0.20	...
31	0.39		...		0.07	
	14.36	7.23	7.42	0 68	5.48	3.62

RAINFALL.

at the Director's house, Botanic Gardens, Singapore, during the second half of the year 1920.

July.	August.	September.	October.	November.	December.
Trace	0.39	...	2.13	Trace	...
1.44	0.03	...	0.01	0.76	...
0.14	1.95	...	...	...	...
0.08	...	...	...	0.02	...
...	...	...	2.02	...	...
0.26	...	0.05	1.06	0.46	...
0.45	0.24	...	...	0.09	3.25
0.05	0.18	...	0.45	1.46	...
1.04	0.01	Trace	0.53	0.13	...
0 01	0.58	0.11	...	0.01	...
...	1.31	0.49	0.02	1.10	...
...	0.03	0.17	0.03	0.03	0.15
1.47	0.40	0.06	Trace	0.04	0.02
0.04	1.73	0.03	0 05	0 09	Trace
...	0.06	0.02	0.19	1.35	...
...	0.01	0.01	Trace	...	...
...	1.19	...	0.35	0.02	0.02
...	0 37	1.31	0.07	...	0.15
...	0.01	Trace	0.65	0.64	0.66
0.34	...	...	0.23	0.31	...
0.74	...	2.20	0.11	0.02	0.04
0.37	...	...	Trace	1.31	0.06
0.03	...	1.17	...	...	0.02
...	0.42	0.95	0.07	0.02	2.32
...	0.42	0.01	0.17	1.54	0.02
...	0.01	...	0.04	0.16	0.16
0 10	...	2.01	0.77	Trace	0.44
1.36	0.42	0.02	0.02	...	...
0.04	...	0.65	0.02	...	Trace
0.01	0.20	0.04	...	...	Trace
0.11	0.90		0.77		0.01
8.08	10.86	9.30	9.74	9.56	7.32

RAINFALL.

at the head of the Waterfall Gardens, Penang, during the first half of the year, 1914.

Readings taken at 8 a.m. and credited to the date in which the twenty-four hours begin. Measurements in inches.

Date.	January.	February	March.	April.	May.	June.
1	...	0.29	...	...	0.15	0.61
2	...	...	...	0.03	...	...
3	0 18	...	...	...	...	...
4	....	0.03	...	2.14	...	0.05
5	...	0 34	...	0.06	1.10	...
6	...	1.50	0.59	...	...	1.33
7	...	...	0.07	1.23	...	...
8	...	0.23	0.03	...	0.05	...
9	0.22	1.25	0.07	0.08	0.33	0.14
10	0.36	...	0.04	...	0.72	...
11	...	...	...	...	1.05	0.57
12	...	...	...	0.45	0 15	...
13	...	...	...	0.04	...	...
14	...	...	...	0.80	0.44	...
15	0.40	...	...	0.03	1.34	0.05
16	...	...	...	0.16	1.26	1.03
17	...	...	..	..	0.03	0.03
18	...	0.41	2.36	0.28	...	1.95
19	...	1.25	..	...	...	1.55
20	...	0.03	...	0.69	1.22	2.15
21	...	1.73	0.32	0.03	...	0.03
22	...	0.05	...	0.73	0.55	...
23	...	0.04	0.03	0.30	...	1.73
24	...	0.03	0.12	0.70	1.24	...
25	...	...	...	0.08	0.19	...
26	...	0.75	...	0.79	0.08	...
27	...	1.20	0.55	0.29	0.06	...
28	...	0.75	0.05	0.27	0.03	...
29	...	..	0.10	...	0.16	...
30	...		0.14	...	0.97	0.10
31	0.03		...	...	0.11	
	1.19	9.88	4.47	9.18	11 23	11.32

RAINFALL.

at the head of the Waterfall Gardens, Penang, during the second half of the year 1920

Date.	July.	August.	Sept.	October.	Nov.	Dec.
1	0.49	0.56	...	0.07	1.64	...
2	...	0.56	...	0.19	0.12	...
3	...	0.05	...	0.60	0.03	...
4	0.03	0.04	...	...	0.03	0.11
5	...	0.09	...	0.04	0.54	...
6	...	...	...	0.36	0.12	...
7	0.15	...	0.38	...	0.35	...
8	0 33	3.12	1.09	...	...	...
9	0.22	0.85	2.20	...	0.08	...
10	...	4.25	0.82	1.14	1.13	...
11	0.56	0.21	0.99	...	...	...
12	...	0.09	1.04	0.96	0.29	2.09
13	...	0 99	...	2.24	...	0.92
14	...	0.03	1.04	1.92	....	0.04
15	...	0.13	1.82	0.27	0.17	0.44
16	...	...	...	0.97	0.03	0.07
17	...	0.45	0.09	0.81	1 27	0.22
18	0.08	...	1.22	0.11	....	0.42
19	...	0.03	0.99	0.62	0.46	3.44
20	...	0.06	0.03	0.79	0.17	1.10
21	0 03	...	0.86	1.11	0.53	0.19
22	...	0.07	0 58	0.15	0.04	0.60
23	...	0.27	0.08	0.20	0 04	1.13
24	...	...	...	0.09	...	0.88
25	...	1.40	...	...	1 74	...
26	...	0.03	2.84	....	2 96	0.03
27	...	0.58	0.28	0.09	0.62	...
28	0.32	0.17	0.98	0.67	0.10	...
29	0.10	6 59	0.06	0.04	0 04	...
30	1.06	0.05	1.07	0.11	0.05	...
31	0.56	2.05		0.13		...
	3.93	22.72	18.46	13.68	12 55	11.68

SUMMARY OF RAINFALL, 1920.

	SINGAPORE.				PENANG.			
	No. of rainy days	Amount of rain in inches	in mm.	Longest Spell without rain	No. of rainy days	Amount of rain in inches	in mm.	Longest Spell without rain
January -	19	14.36	390	4 days.	5	1.19	30	15 days
February -	17	7.23	184	4	16	9.88	251	8
March -	19	7 42	188	4	13	4.47	114	7
April - -	19	3.68	93	3	20	9.18	233	2
May - -	18	5.46	139	5	21	11.23	285	3
June - -	13	3.62	92	6	14	11.32	288	6
July - - -	20	8.08	205	5	12	3.93	100	6
August -	22	10.86	276	4	25	22.72	577	2
September	19	9.30	236	5	20	18.46	469	6
October -	25	9.74	247	2	24	13.88	353	3
November -	22	9.56	243	9	24	12.55	319	2
December -	17	7.32	186		15	11.68	297	7
Total ...	230	96.63	2454	...	209	130.31	3310	

Greatest amount in 24 hours	3.82 in. or 97 mm.	6.59 in. or 168 mm.
,, ,, 48 ,,	5.47 ,, 138 ,,	6.64 ,, 169 ,,
,, ,, 72 ,,	9.12 ,, 232 ,,	8.69 ,, 221 ,,
Excessively rainy periods, more than 5 00 having fallen in 72 hours (Jan.) -	1	3 June Aug. (2)
No. of days when condition persisted -	1	6
Periods of comparative drought, less than 0.02 having fallen in 120 hours Jan (2) Mch. April (2) June July (2) Sept. Dec. - - - - -	12	9 Jan. Feb. Mch. (2) June July (2) Sept. Dec.
No. of days when the condition occurred. - - - - - -	28	30

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Errata.

On the plate opposite p. 92 for 332 read 342.

p. 135 second footnote for 1253 read 1532,

p. 136 second delete the 30th line,

p. 141 last column, the asterisk is one line too high.

Departmental Notices.

A list of plants which can be purchased at the Botanic Gardens, in Singapore and in Penang, can be had upon application. The same list appears at intervals in the Government Gazette.

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